Extreme Temperature Events (summertime) and Acute Myocardial Infarction in Maryland

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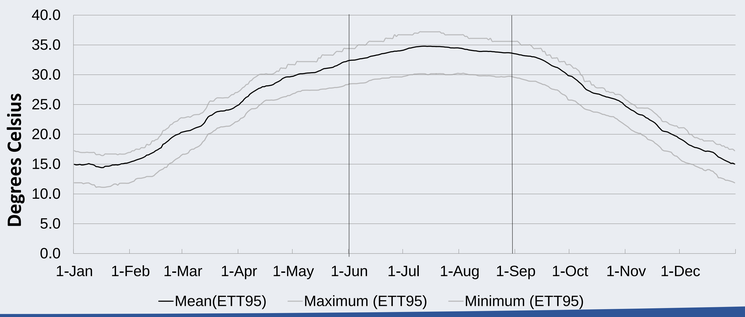
BACKGROUND

- Previous studies have found associations between ambient temperature and risk of cardiovascular events, including acute myocardial infarction (AMI).
- Few studies have focused on the risk associated with extreme summer temperatures or demonstrated which populations are most vulnerable to the effects of extreme heat.
- Additional studies are needed as more intense and frequent heat waves are expected with global climate change[1].

METHODS

- Hospital discharge data were obtained from the Maryland Department of Health and Mental Hygiene. All records for in-patient hospitalizations with a principal discharge diagnosis of acute myocardial infarction (ICD-9 410) were included.
- Extreme heat events were defined as days when the temperature exceeded the 95th percentile of county and calendar specific maximum daily temperatures calculated using 30 year baseline (1960-1989).
- A time-stratified case-crossover design was used to analyze the association between AMI hospitalizations and extreme heat events in summer months (Jun-Aug) with 0, 1 or 2 lag days.
- Based on prior literature suggesting potential effect modification by age[2], stratified conditional logistic models by age category were used to examine extreme heat effects within race/ethnicity and gender subgroups.
- This study was approved by the UMD institutional review board.

Figure 1: Mean, maximum, and minimum ETT_{95} cutoff values across all MD counties



RESULTS

Table 1: Characteristics of acute myocardial infarction hospitalizations during summer months in Maryland, 2000-2012

Characteristic	Age 18-64		Age 65+	
	# Cases	% of Cases	# Cases	% of Cases
Total	14,067	43.1	18,603	56.9
Gender				
Female	4,333	30.8	9,615	51.7
Male	9,734	69.2	8,988	48.3
Race / Ethnicity				
Non-Hispanic Whites	8,697	61.8	13,646	73.4
Non-Hispanic Blacks	3,617	25.7	3,113	16.7
Hispanic	252	1.8	164	0.9
Other Races	725	5.2	688	3.7
Unreported	776	5.5	992	5.3

- There were 32,670 AMI hospitalizations during the summer months in Maryland between 2000 and 2012.
- The majority of cases were among those aged 65 or older (18,603 cases; 56.9%), Males (18,722 57.3%), and non-Hispanic whites (22,343, 68.4%).

Table 2: Odds ratios and 95% confidence intervals of acute myocardial infarction hospitalizations and exposure to extreme heat (ETT95 exceedance) during summer months in Maryland, 2000-2012

Characteristic	Cases	ETT_{95}_Lag0	ETT_{95}_Lag1	ETT_{95}_Lag0_2
Overall Model	32,670	1.11 (1.05 – 1.17)	1.16 (1.09 – 1.22)	1.17 (1.12 – 1.22)
Gender				
Male	18,722	1.12 (1.05 – 1.21)	1.19 (1.11 – 1.28)	1.18 (1.12 – 1.24)
Female	13,948	1.09 (1.00 – 1.19)	1.10 (1.01 – 1.20)	1.16 (1.09 – 1.23)
Age				
Age 18-64	14,067	1.10 (1.02 – 1.20)	1.15 (1.06 – 1.25)	1.16 (1.09 – 1.23)
Age 65+	18,603	1.11 (1.04 – 1.20)	1.16 (1.08 – 1.25)	1.18 (1.12 – 1.24)
Race				
Non-Hispanic White	22,343	1.09 (1.02 – 1.16)	1.16 (1.09 – 1.24)	1.18 (1.12 – 1.23)
Non-Hispanic Black	6,730	1.27 (1.12 – 1.44)	1.15 (1.02 – 1.30)	1.21 (1.10 – 1.33)

Table 3: Odds ratios and 95% confidence intervals of acute myocardial infarction hospitalizations and exposure to extreme heat (ETT95 exceedance) during summer months in Maryland, 2000-2012

Characteristic	Cases	ETT95_Lag0	ETT95_Lag1	ETT95_Lag0_2
Non-Hispanic White				
Age 18-64	8,697	1.01 (0.91 – 1.13)	1.13 (1.01 – 1.25)	1.13 (1.05 – 1.23)
Age 65+	13,646	1.14 (1.05 – 1.24)	1.18 (1.09 – 1.29)	1.20 (1.13 – 1.28)
Non-Hispanic Black				
Age 18-64	3,616	1.37 (1.16 – 1.62)	1.20 (1.02 – 1.42)	1.24 (1.10 – 1.41)
Age 65+	3,113	1.16 (0.96 – 1.40)	1.09 (0.90 – 1.32)	1.17 (1.02 – 1.35)
Male				
Age 18-64	9,734	1.14 (1.04 – 1.26)	1.17 (1.06 – 1.29)	1.18 (1.09 – 1.27)
Age 65+	8,988	1.10 (0.99 – 1.22)	1.23 (1.11 – 1.36)	1.18 (1.09 – 1.27)
Female				
Age 18-64	4,333	1.02 (0.87 – 1.19)	1.10 (0.95 – 1.28)	1.11 (0.99 – 1.25)
Age 65+	9,615	1.13 (1.02 – 1.24)	1.10 (1.00 – 1.22)	1.18 (1.09 – 1.27)

DISCUSSION

- Overall, extreme heat events on the day of hospitalization were associated with an increased risk of AMI (OR=1.11; 95%CI: 1.05-1.17).
- Results considering lag periods of extreme heat on days immediately prior to hospitalization were comparable.
- We found the suggestion of effect modification by age group and race/ethnicity (Table 3). Among non-Hispanic whites, higher risk of AMI was found among those aged ≥65 but not among those aged 18-64. In contrast, among non-Hispanic blacks, significantly higher risk was seen among those aged 18-64 but not among those ≥65.
- Our findings show extreme heat events increase the risk of AMI. As extreme weather events are expected to be more frequent and intense with changing climate, additional studies are needed to understand the differential susceptibility across ethnic subgroups and geographic areas.

References:
[1]Meehl, G. A. and C. Tebaldi (2004). "More intense, more frequent, and longer lasting heat waves in the 21st century." Science 305(5686): 994-997.
[2]Loughnan, M. E., N. Nicholls, et al. (2010). "The effects of summer temperature, age and socioeconomic circumstance on acute myocardial infarction admissions in Melbourne, Australia." Int J Health Geogr 9: 41.

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